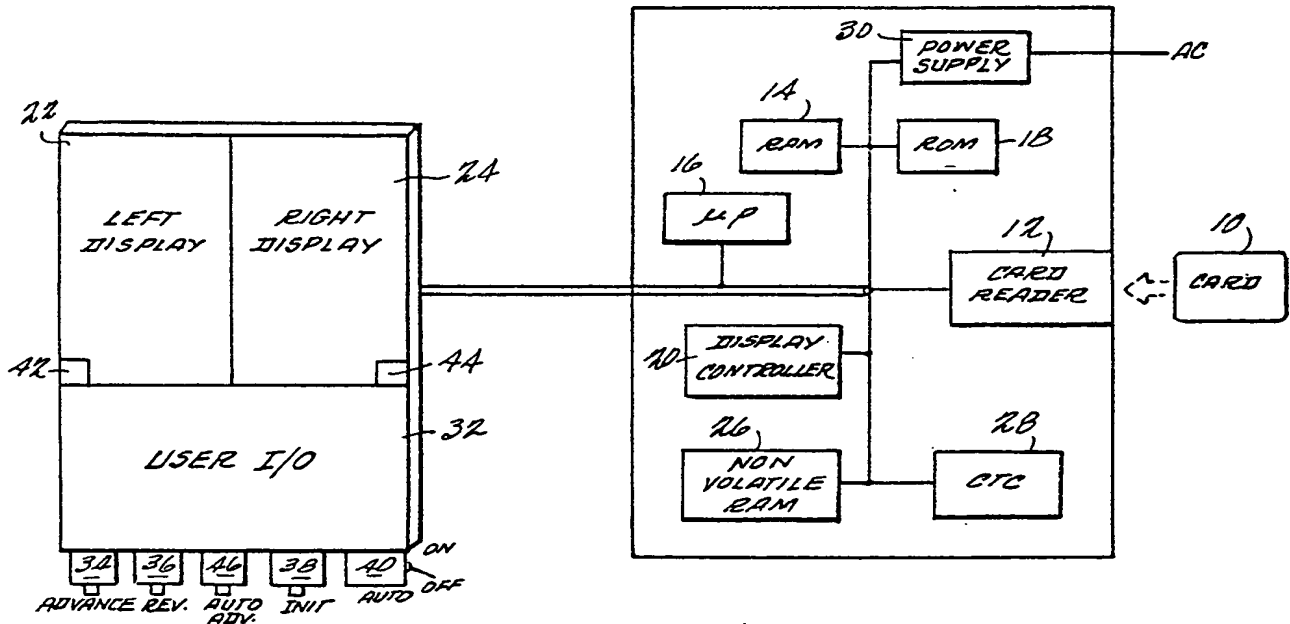




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(54) Title: ELECTRONIC BOOK DEVICE**(57) Abstract**

A device for reading prestored information from an optical storage medium (10). This device has a book structure with two covers (254, 256) and a hinge (252) pivotally connecting these two covers to allow the device to simulate the appearance of a book. On the interior of these two covers are displays (22, 24) for displaying the information read from the optical storage medium (10). The microprocessor controls the paging of the book under supervision of the user. The exterior of the book is covered with a leather-like material thereby imitating the appearance of a hard-bound book. A bookmark function is provided so that a user will automatically begin reading at the previous ending point.

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ELECTRONIC BOOK DEVICEFIELD OF THE INVENTION

This invention relates in general to data storage and retrieval. Specifically, the invention provides a portable device in the shape and form of a book which reads data from a laser or photolithographically written storage device and displays this data on a two page visual screen. The device is housed in a two panel hinged carrier which has the outward appearance of a book, so that this device in conjunction with the imprinted source can be used as a substitute for a book, and obtain user acceptance therefor.

BACKGROUND OF THE INVENTION

Books are an integral part of existence in modern society. Books are available describing a multitude of subjects from fiction to technical publications, and one can scarcely exist without at some time reading a book or magazine of some kind. Some books, such as fiction are written once and then do not become significantly dated by the passage of time. Other books, such as those describing technical subjects, do become dated with the passage of time, and thus new editions or new volumes are necessary to continue adequately describing the subject matter.

The traditional form for books has been printing on paper with each two pages of the book occupying a single sheet of paper. The cover of the book can be either hard bound which is generally

formed from some kind of cardboard or soft bound which is generally formed from a thicker gauge of paper than that the pages are printed upon.

Problems with this form of information storage exist
5 with the depletion of the resources which are traditionally used to make paper and cardboard, and the size of books.

In recent years, there has been much concern about depletion of the world's trees. At
10 the very least, sufficient depletion of the world's forests would upset the ecological balance of the earth in some way. Certainly, a significant contributor to the depletion of the world's forests is for making paper, and a significant use of paper
15 is in printing books. However, many books are printed with the concept of "throwaway" in mind, and are read only once, while other books (such as technical books) go quickly out of date so that they too will be eventually discarded.

Also, to collect a multitude of books one must have sufficient storage space to store these books. Being that these books can be considerably heavy, the storage means used must also be
20 substantial. Thus, modern libraries must be substantially physically large in order to hold all the desired volumes. Often, a limiting factor in the size of a library's collection is the amount of shelf space.

A further problem with paper books is in
30 their considerable weight. This increases the costs of transportation of these books.

Up until now, there has been no satisfactory solution proposed for the above-
mentioned problems of wastefulness of natural
35 resources, volume of the books, and weight of the

books. One such solution proposed has been using a portable computer to read the information from a storage device such as a floppy disc, and display this information on the screen of the portable
5 computer. This has not obtained wide user acceptance because it is very inconvenient to read, there being insufficient line space on a typical screen to display enough data for the user to comfortably read. In addition, reading from a personal computer
10 does not meet a user's expectation of "reading", and therefore a user is typically hesitant to adopt this new medium.

A new medium for storage of data which has been relatively recently invented involves laser
15 technology. An example of such a medium is the compact disc which is now being used to store audio data in a digital form for later use by a user. This medium has gained wide acceptance in the field of high-quality audio.

20 In general, this laser technology uses a medium which records bits on a surface. These bits can be read from the surface by a focused laser beam. An example of this medium and technology can be found in U.S. Patent 4,284,716 to Drexler et al.,
25 the disclosure of which is herein expressly incorporated by reference. Drexler et al. describes the technology which is used in the present invention to obtain the desired result.

Thus, it is an object of this invention to
30 create a device which will allow use of the laser recording technology to replace paper as a means for publishing books. This device will include all the functions that a user is accustomed to in a book and in fact will be in the same general shape that a
35 user now recognizes as a "book".

However, the device itself which will read the storage medium is reusable and can be used to read an unlimited number of different books as imprinted on laser storage media. Thus, by use of the present invention a library of different books or publications would only need to contain a number of laser storage devices, each laser storage device preferably being the size of a standard credit card. Thus, depletion of resources could be cut back, and a greater library could be stored in much less volume.

SUMMARY OF THE INVENTION

To achieve these objects, the present invention teaches an electronic book which has a two page visual display. These displays are actually a pair of flat display screens. Textual material is recorded on a laser imprinted, optically readable card. A card reader sequentially transfers textual information recorded on the card onto screens, two pages at a time. This device can be battery or AC operated so that a user can read information from the optical card either in a fixed or transient location, for instance in the home or on an airplane. The user of the book controls the visual display so that he or she can read the book at a desired pace. User controls are available which automatically advance or reverse the screen display two pages at a time, just as in a real book. A bookmark function is also available so that the user can start reading at the last location.

The device is preferably housed in a two panel hinged carrier having an appearance of a hard bound book. Thus, from the user's point of view,

this book is similar to a conventional book, with a button being pushed rather than turning a page, and the "print" being optical rather than hard copy.

BRIEF DESCRIPTION OF THE DRAWINGS

5 An exemplary and presently preferred embodiment of the invention will be described in detail with reference to the accompanying drawings, wherein:

FIGURE 1 shows a block diagram of the
10 electronic book device according to the present invention;

FIGURE 2 depicts the laser card used as the storage medium for the device;

FIGURE 3 shows schematically the medium
15 used to encode the laser information on the card storage device;

FIGURE 4 shows schematically the reader used to read data off of the card device;

FIGURE 5 is a flow chart of a typical
20 program used to operate the book device;

FIGURE 6 shows a side edge view of the book device when closed;

FIGURE 7 shows a front view of the book device when closed;

FIGURE 8 shows a side view of the book device when closed;

FIGURE 9 shows an edge view of the book when opened;

5 FIGURE 10 shows a front view of the open book;

FIGURE 11 shows an isometric view of the open book in relief as used; and

10 FIGURE 12 depicts a frontal view of the electronic book device when opened and in use.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A block diagram of the electronics of the entire operational device is depicted in FIGURE 1.
15 The structure and the operation of this device will be described herein.

As previously stated, the written information which is intended to be perceived by the user is stored on laser card 10. This information
20 is permanently stored, and can be read by a laser source. The laser source that reads this device resides in card reader 12. Card reader 12 reads the bits off of the card, and conveys the information on the card to a random access memory (RAM) 14. In
25 this embodiment, the card used to store the information is a DREXON (TM) laser card manufactured by Drexler Technology Corporation, Mountain View, California. The reader 12 can be any standard reader for the particular card 10, and in this
30 embodiment is an SRI International Reader.

Microprocessor 16 operates according to a predetermined program stored in read only memory (ROM) 18, and directs card reader 12 to read data from card 10 when necessary. The operation of the
5 microprocessor will be more fully described with reference to the flow chart of FIGURE 5.

Under control of the microprocessor, the card reader reads two pages of data, and conveys this data to RAM 14. Thus, RAM 14 holds two "pages"
10 of information. Display controller 20, under the direction of microprocessor 16 then formats this data in suitable form to be displayed on left display 22 and right display 24 respectively. The "page number" will be stored in a nonvolatile random
15 access memory (RAM) 26, thus allowing a bookmark effect, whereby the user's last read page will automatically be kept and retrieved upon a subsequent reading off the book. A counter and timer (CTC) 28 function in executing the
20 microcomputer's internal program, and in certain user functions.

The entire unit is powered by power supply/battery 30. This functional block contains an AC supply which can be operational when the user
25 is in a fixed location such as in one's home or office. However, when the AC power source is removed and the device is still on, the operation of the device will automatically be shifted to a contained battery. Thus, the device will also be
30 usable when the user is remote from a source of power, such as during transportation.

A user I/O section 32 is also provided to allow the user to perform certain functions. These functions are performed by the controls depicted in
35 FIGURE 1. A first control 34, labeled "ADVANCE" in

FIGURE 1, is a momentary pushbutton switch which controls the advance of the information on the pages. By depressing this switch, the two pages being currently displayed on left and right displays 5 22 and 24 are removed and the subsequent two pages of information are displayed therefor. Thus, pushing advance button 34 is equivalent to turning the page in a regular book. A momentary contact reverse (REV) switch 36 is provided to reverse one 10 page. Thus, this control allows the reader to reread the previous two pages or the pages before that. Thus, by using the advance and reverse buttons, the user can "leaf through the book" in forward or reverse directions.

15 Also provided is momentary contact switch 38, which is an initialize (INIT) switch. In the normal mode of book viewing Operation, when the device is turned on, the display will show the page which was last viewed by the viewer. Therefore, 20 when the viewer should decide to read a new book, the system must be notified to begin this book at the first page. This notification is accomplished by initialize switch 38.

Further provided as part of user I/O 25 section 32 is a three position toggle switch 40. This three position toggle switch controls the on/off/auto state of the device. In the off state, the device is in a power off mode and no user readable screens are provided. In an on state, the 30 device is powered on. When the device is in the "auto" state, the book will automatically power on when the display is opened and automatically power off when the display is closed. The open closed position of the display is sensed by contact 35 switches 42 and 44. These contact switches will

typically be Hall effect sensors, which sense the proximity of one sensor to the other.

Further provided on user I/O section 32 is auto advance potentiometer 46. This potentiometer permits automatic advance of the pages after a predetermined lapse of time. When the potentiometer is in the full counterclockwise position, this function is off. When the potentiometer is turned clockwise, the automatic paging is initiated. The user can set the automatic advance to suit his reading speed and allows the turning of the pages of the book without further user intervention.

Referring to FIGURE 2, a more detailed drawing of card 10 is shown. The card used in this embodiment is a Drexon laser card, which has the size of 3.75 x 2.125 x .030 inches, which is the standard credit card size. At the present time this laser card has a storage capacity of up to 2 megabytes, which corresponds to approximately 800 pages of typewritten text. It is planned that in the future ten megabytes will be available on a similar card. Card 10 has laser stripe 50 upon which the desired data is encoded. The technique of this encoding will be briefly described with reference to FIGURE 3.

Laser stripe 50 has a number of layers. An anti-scratch coat 52 overlays an encapsulation layer 54. Below these two layers is crust layer 56. Crust layer 56 can be permanently altered in structure by external application of a laser. By focusing a laser on an area of crust 56, an indentation such as 58 can be formed in crust layer 56. Strip 50 may also be encoded using lithographic techniques.

In operation, low power laser light is shined onto laser stripe 50. An impinging beam 60 traverses anti-scratch coat and encapsulation layers to impinge upon crust layer 56. Crust 56 in its normal state will reflect approximately 40% of the laser light impinging on it such as in reflected laser beam 62. However, if an indentation 58 has been made in crust layer 56 Only approximately 6% will be reflected as in reflected wave 64.

Therefore, the two different levels of reflection can be used as ones and zeros for storing information.

A typical reader for a card such as this is shown in block diagram in FIGURE 4. Reader 12 has a slot 70 into which card 10 is adapted to be placed. Once in slot 70, a low power laser source 72 shines a laser beam at a selected spot on the laser stripe 50. This selected spot is determined by the desired address to be read. The laser light 74 is reflected as reflected beam 76. Reflected beam 76 is detected by detector 78 which decides whether the reflected beam corresponds to a one or a zero. The one or zero obtained from laser card 10 is then routed to a shifting means 80, in this case a charge coupled device. The information is formatted into word format by charge coupled device 80 and routed to I/O controller 82 where the information is formatted for output to a standard data bus.

In this embodiment, a standard card reading device will be used, such as an SRI International Reader. Many variations on such card readers are available.

FIGURE 5 shows a flow chart of the program used to control the operation of the present

embodiment. After power on at step 200, the last address which was displayed on the screen is read from nonvolatile RAM 26 into the address buffer. This last address corresponds to the bookmark function and marks the page at which the user was last reading the book. The pages at this last address are read from card 10 into RAM 14 at step 204. This information is then displayed on the screens 22 and 24 at step 206. Step 208 tests for the presence of an advance signal having been entered. If this advance signal has been entered, the address in the address buffer is incremented at step 210 and control is returned to point 212 wherein data from the card 10 is read and displayed. If there has been no advance signal detected at step 208, a reverse signal is tested for at step 214. If a reverse signal is detected at step 214 the address in the buffer is decremented at step 216 and control is returned to point 212. In the absence of a reverse signal at step 214, an initialize signal is tested for at step 218. If this initialize signal is detected, the address is set to the lowest possible address (corresponding to the first page of the book) at step 220, with control being transferred to point 212. In the absence of an initialize signal, the presence of the auto advance function is tested for at step 221. If the auto advance function is not initiated, control is returned to point 222 so that the advance, reverse, initialize, and auto advance functions are continually polled during the operation of the device. If the auto advance function is on, a timer is used to time the advance of pages. The operation of this timer is tested for at step 223. If the timer has not been started at step 223 it is

subsequently started at step 224 and control is transferred to step 222. If the timer has been started at step 223 the timer being elapsed is tested for at step 226. If the timer is not elapsed
5 at step 226 control is again transferred to point 222. If the timer is elapsed at step 226, the address in the address buffer is incremented at step 228, and control is subsequently transferred to step 212.

10 A software timer has been described, however, this timer can be embodied by either a software timer or a hardware timer.

A novel feature of the present invention lies in its particular shape and packaging, allowing
15 a user to feel like a "real" book is being read, rather than a portable computer reading laser or photolithographic imprinted data off a laser card. This packaging is diagrammed in more detail in FIGURES 6 through 12.

20 Some typical measurements and drawings of the book device as envisioned are shown in FIGURES 6 through 12.

FIGURE 6 shows a diagram of the device when the book is closed. Shown in perspective are left
25 display 22 and right display 24. Also shown is circuit board 250 upon which the components identified in FIGURE 1 are located. Also, hinge 252 is shown, which allows the book to be opened along the axis defined by hinge 252. Front cover 254 and
30 rear cover 256 in addition to spine 258 can also be seen in FIGURE 6. The exterior surfaces of these covers 254 and 256 and spine 258 can typically be covered with a leather-like substance to imitate the appearance of a hard bound book.

FIGURE 7 shows a side view of the book device. Front cover 254 is shown, which is manufactured to simulate the appearance of a hard bound cover of a book. FIGURE 8 shows a side edge of the book as viewed in FIGURE 7 as closed. Reference numbers are shown, which are the same as those in FIGURE 6.

FIGURES 9 and 10 depict the book in its open state. Referring to FIGURE 9 left display 22 and right display 24 can be seen in relief. Also, hinge 252 is shown. Referring to FIGURE 10, a likely location for user I/O section 32 is seen along with other elements previously mentioned. FIGURES 11 and 12 show isometric views of the book as open and in use. From these views, a flavor of the capacity for this medium to replace the usual printed book can be gleaned.

Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. For instance, the display screen used could be a one page screen, rather than a two page screen. Also, the storage medium used could be optical, photolithographic, magnetic, or any other data storage medium. Accordingly all such modifications are intended to be included within the scope of this invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A hand-held electronic book device comprising:
 - a book structure having two covers and
 - 5 a hinge arrangement connecting said two covers;
 - means for receiving and reading
 - information from an encoded storage medium; and
 - display means, located in an interior
 - portion of said book structure defined by said
 - 10 covers, for displaying said information read from
 - said storage medium.
2. A device as in claim 1 wherein said receiving means further comprises user I/O means for allowing said user to adjust said information being
- 15 displayed.
3. A device as in claim 1 wherein said receiving means further comprises:
 - advance switch means for advancing an
 - address of said information being displayed;
 - 20 reverse switch means for decrementing
 - said address;
 - and
 - initialization switch means for
 - initializing said address.
- 25 4. A device as in claim 3 further comprising automatic advance means for allowing said address to automatically advance at a predetermined rate, controlled by said user.
5. A device as in claim 1 further
- 30 comprising nonvolatile random access memory means

for storing the address of the last information displayed.

6. A device as in claim 1 further comprising power Source means for powering said device, said power source means including an AC adapter and batteries.

7. An electronic book device for reading information from a storage medium and displaying said information to a user, comprising:

10 reader means adapted for reading information from a determinable address on said storage medium;

display means for displaying said information;

15 controlling means for modifying said address; and

a book structure including: a) two covers, said display means being located inside said covers, b) hinge means, pivotally connecting said

20 covers together, for allowing said book to be opened so that said screens are visible and for allowing said book to be closed so that said screens are not visible.

8. A device as in claim 7 further comprising user I/O means for allowing user interface with said controlling means.

9. An electronic book device comprising:

display means for displaying information;

means for reading prestored
information from a storage medium and displaying
information on said display means;

a book structure housing said display
5 means and said reading means including:

a) two covers, said display means
being located on the interior of said two covers; b)
hinge means for pivotally coupling said two covers
to one another, and c) a spine, covering said hinge
10 means.

10. A device as in claim 9 wherein said
covers and said spine are coated with leather-like
substance on their exterior surface.

11. A device for reading electronically
15 stored data of the type having a data reader,
adapted to read data from a prestored storage
medium, display means for displaying this
information to a reader, the improvement comprising:
a book structure, housing said device,
20 having two covers with said display means coupled to
an interior surface of at least one of said covers,
and hinge means for pivotally coupling said covers
to each other.

1 / 6

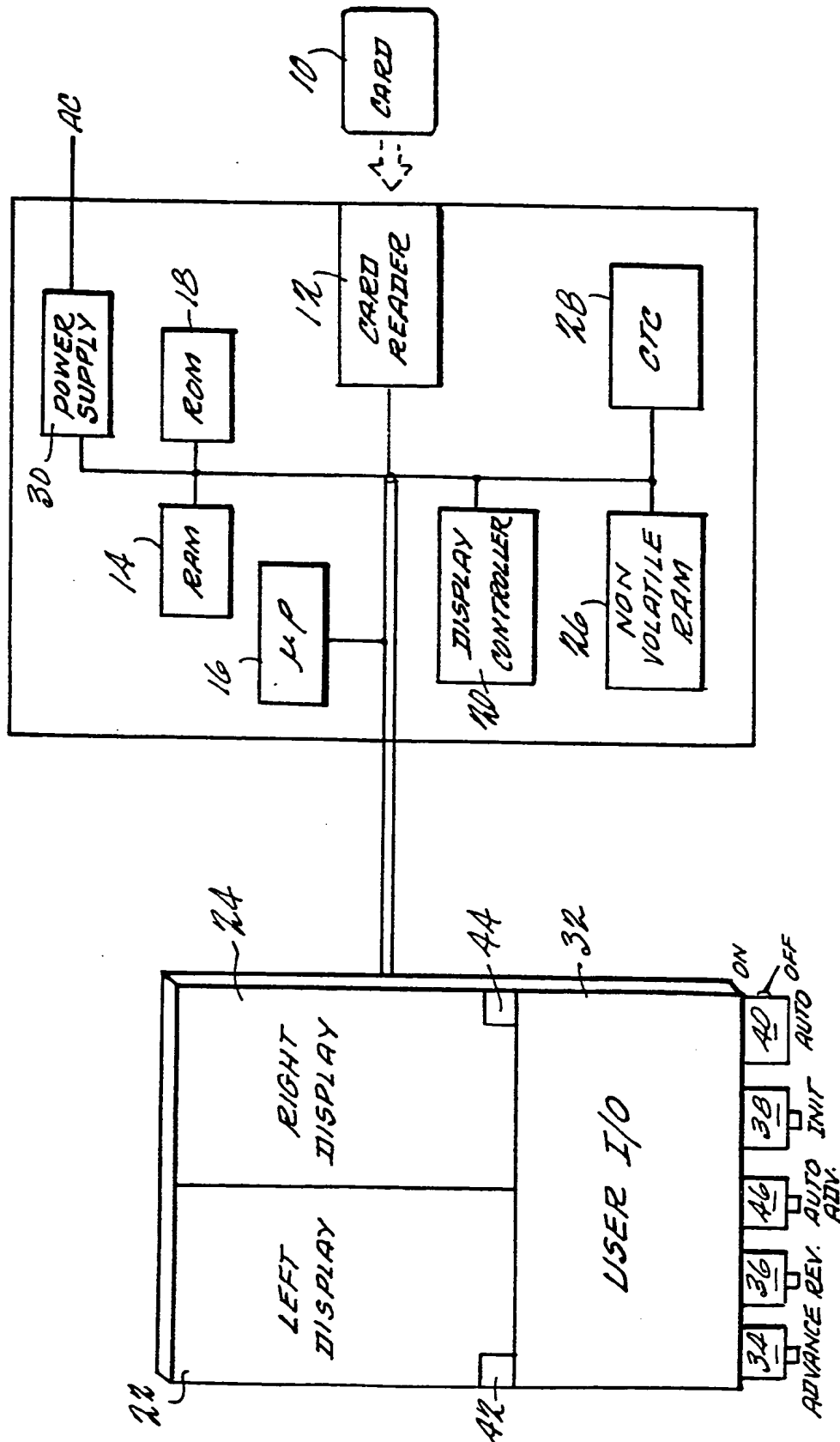


FIG. 1

SUBSTITUTE SHEET

2 / 6

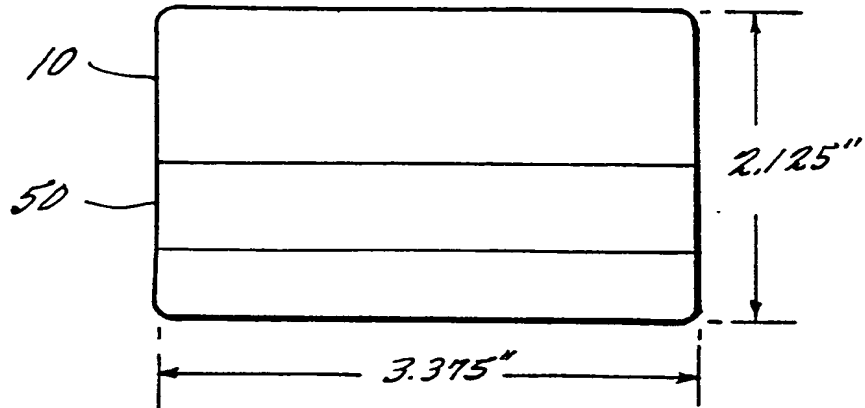


FIG. 2

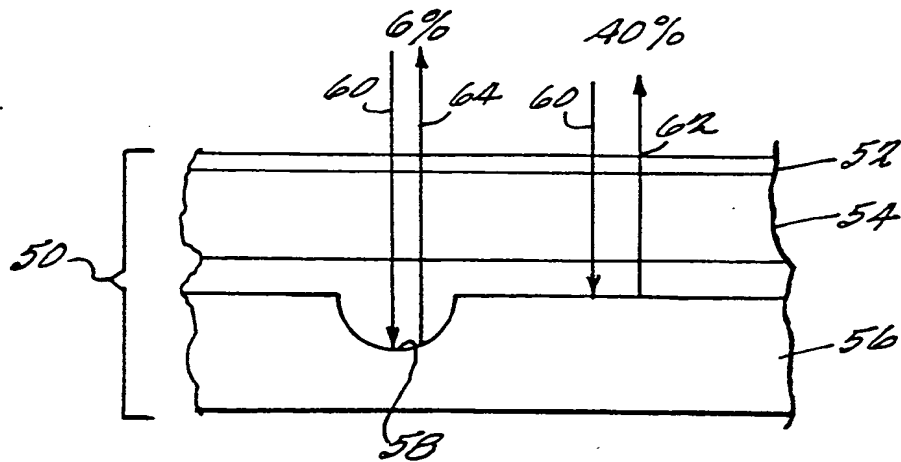


FIG. 3

3 / 6

FIG. 4

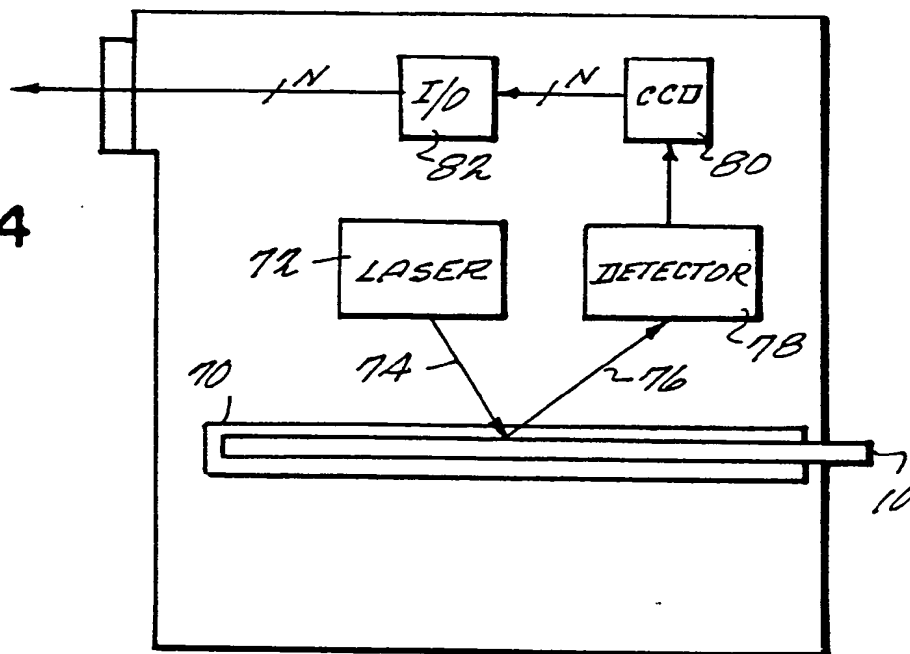


FIG. 7

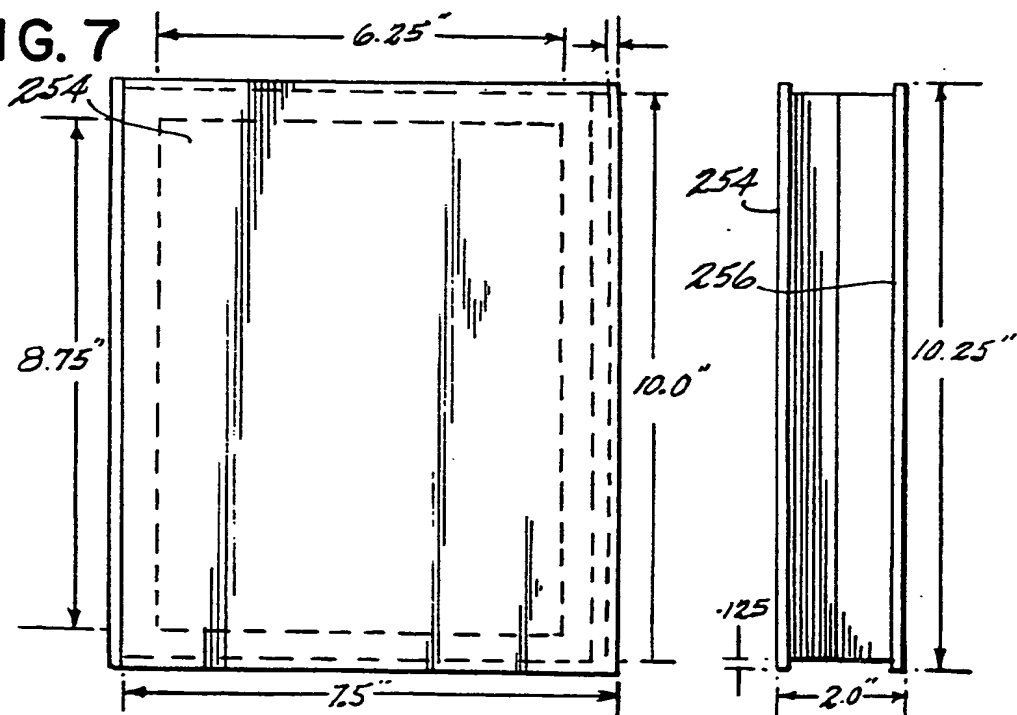


FIG. 6

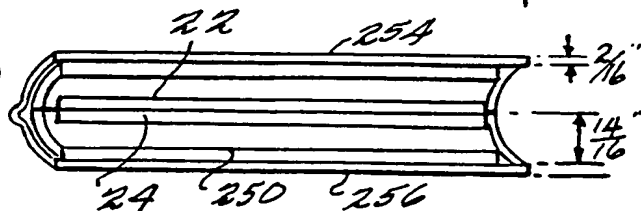
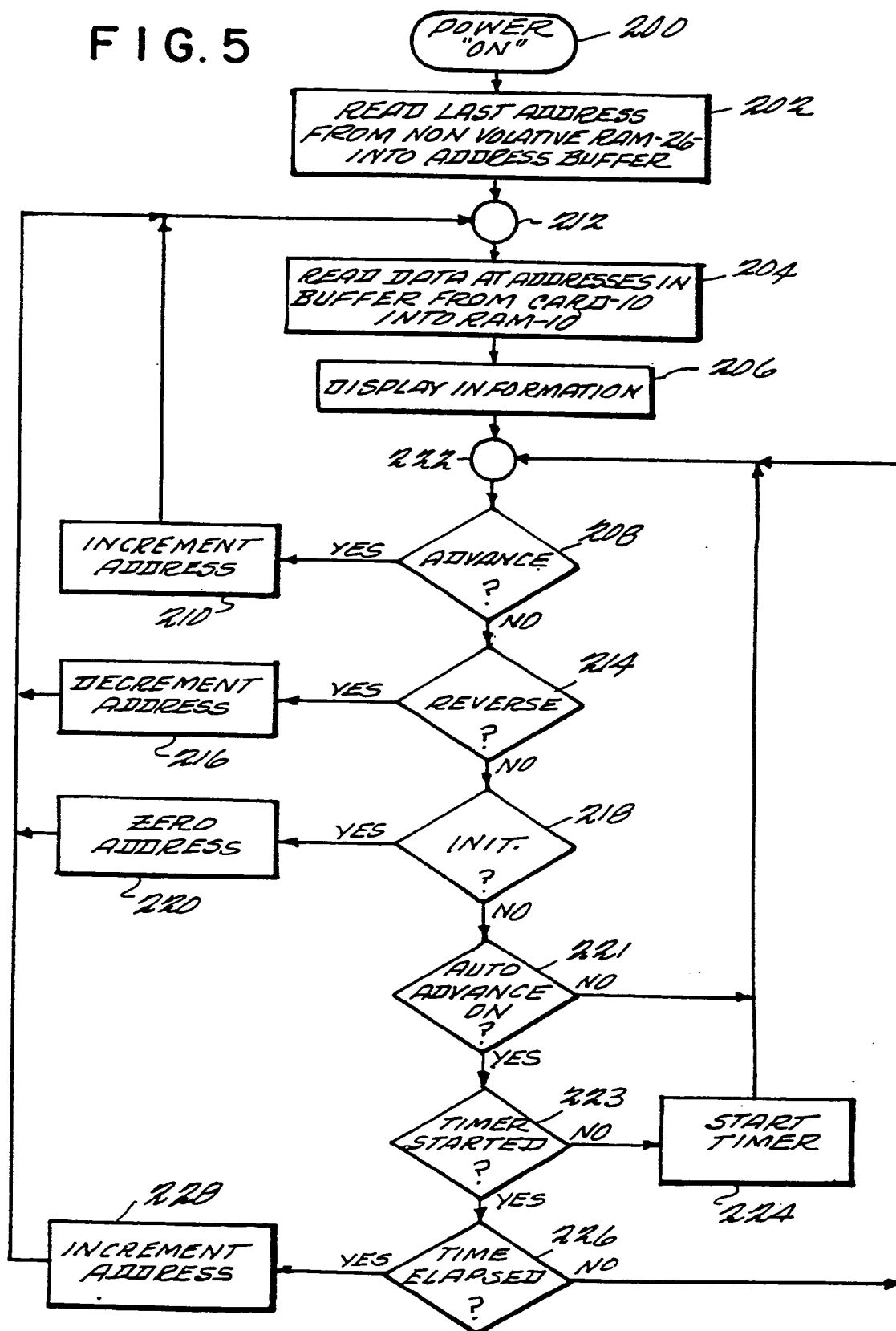


FIG. 8

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4 / 6

FIG. 5



5 / 6

FIG. 9

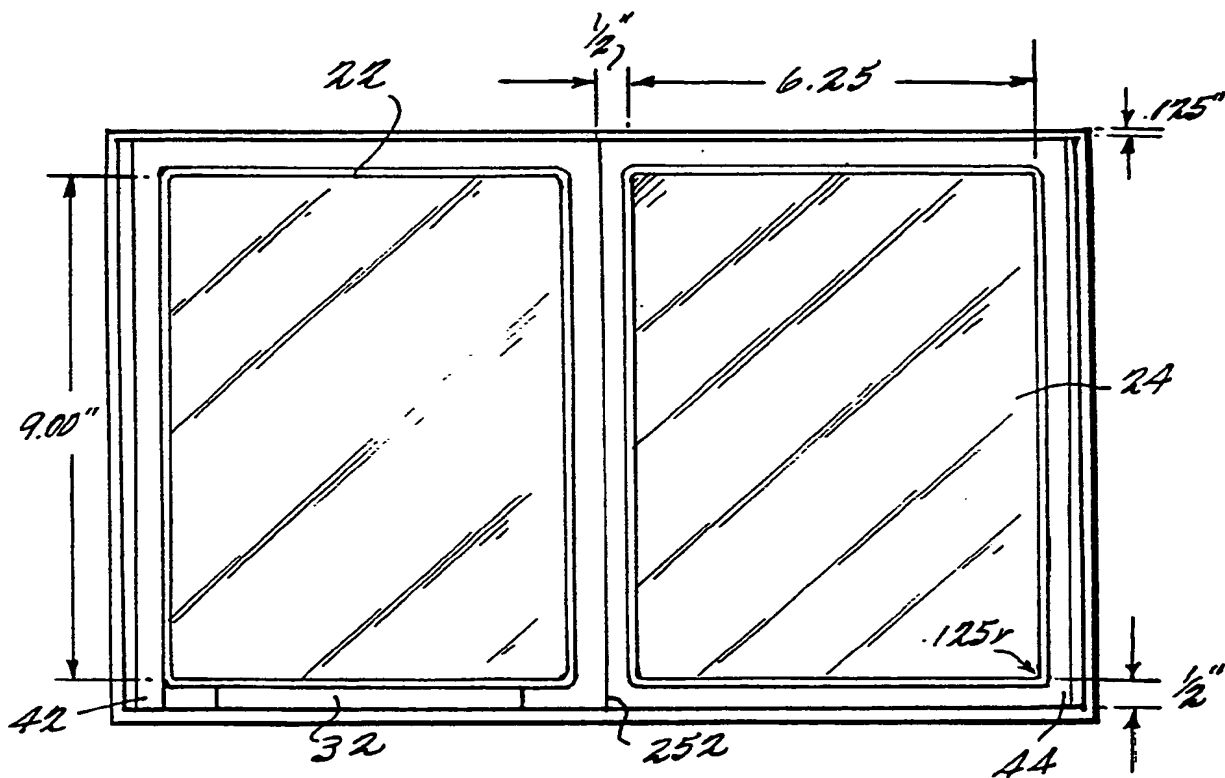
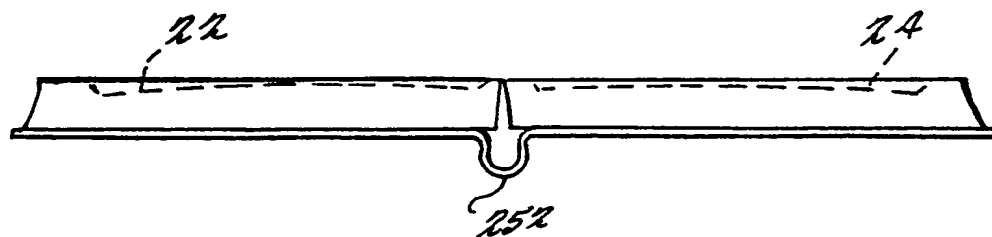


FIG. 10

6 / 6

FIG. II

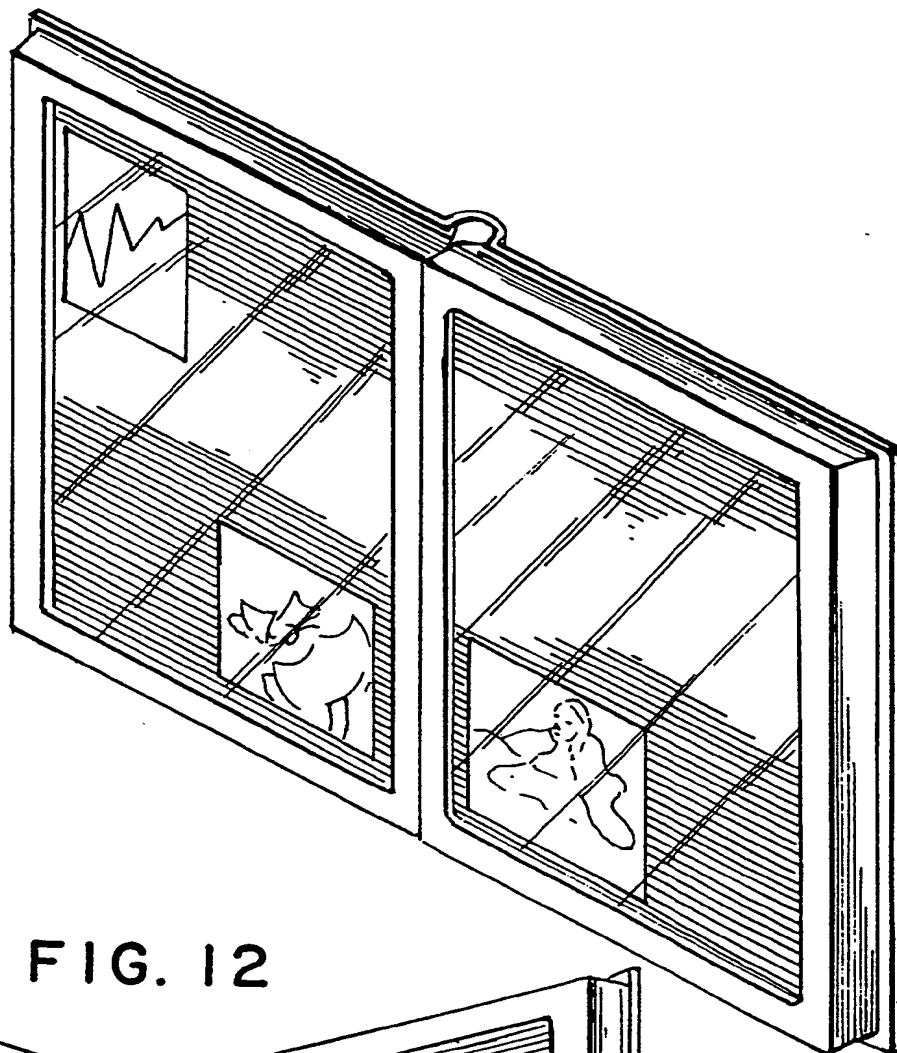
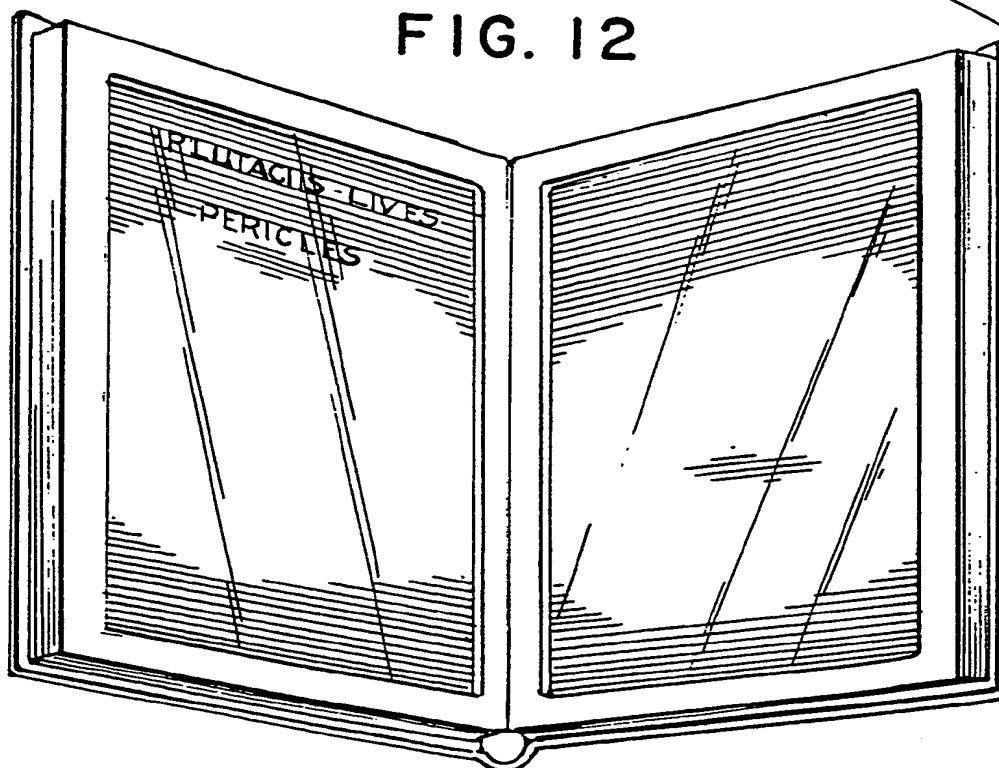


FIG. 12



INTERNATIONAL SEARCH REPORT

International Application No **PCT/US86/01768**

I. CLASSIFICATION F SUBJECT MATTER (If several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
INT. Cl. ⁴ G06F 3/06		
U.S. Cl. 340/706, 711, 365R; 364/708		
II. FIELDS SEARCHED		
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Classification System	Classification Symbols	
U.S.	340/706, 711, 365R 364/708, 709 178/18	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X Y	US,A 4,517,660 (Fushimoto et al.) 14 May 1985, see Abstract, Fig. 1,2 column 2, lines 39-69, column 3, lines 25-69, column 4, lines 1-11	<u>1,2,7-9,11</u> 3-6,10
Y	US,A 4,497,036 (Dunn), 29 January 1985, see column 2, lines 18-28, 50-69, column 4, lines 20-35, column 5, lines 62-67, column 6, column 7.	3-6,10
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>¹⁵ * Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ²	Date of Mailing of this International Search Report ³	
6 October 1986	10 OCT 1986	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
ISA/US	Ruffin B. Cordell	

Form PCT/ISA/210 (second sheet) (May 1986)

1 / 6

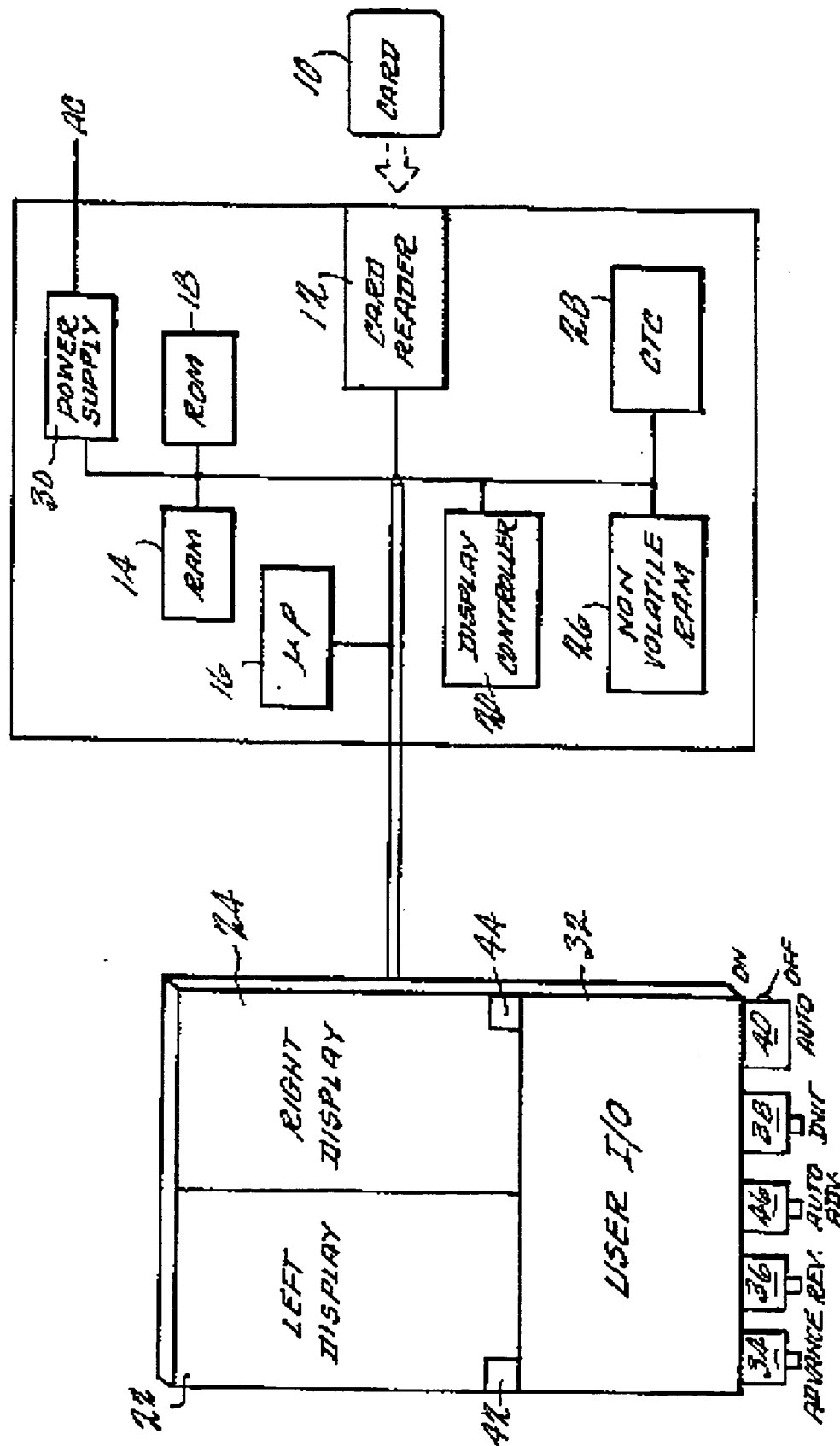


FIG. 1

SUBSTITUTE SHEET

2 / 6

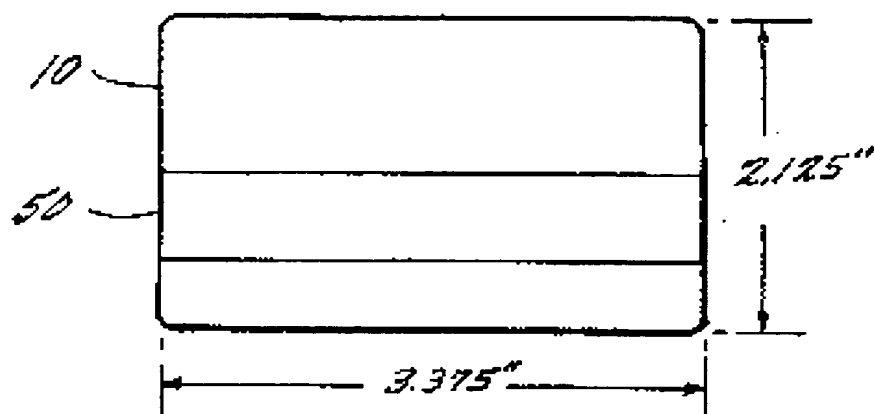


FIG. 2

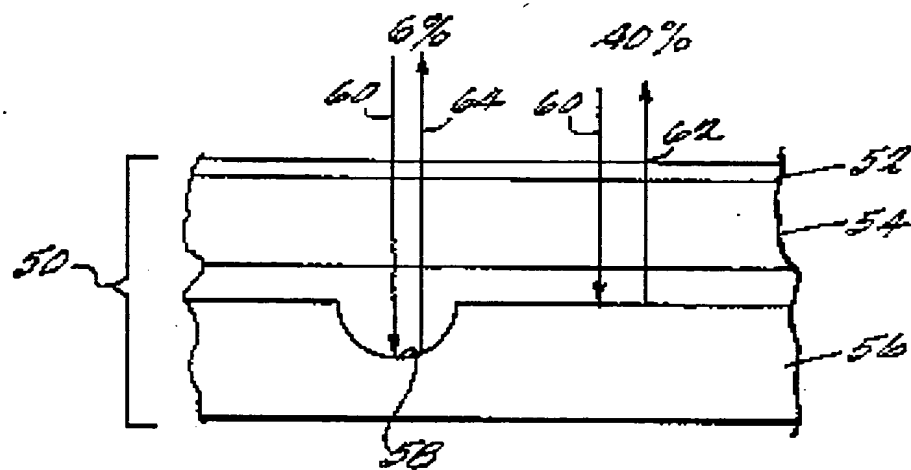


FIG. 3

3 / 6

FIG. 4

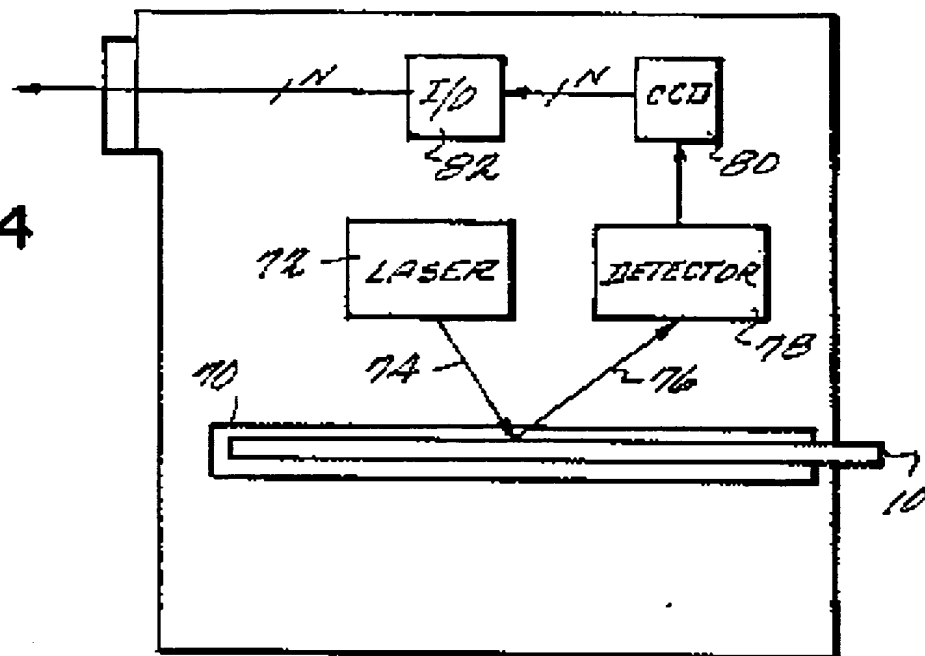


FIG. 7

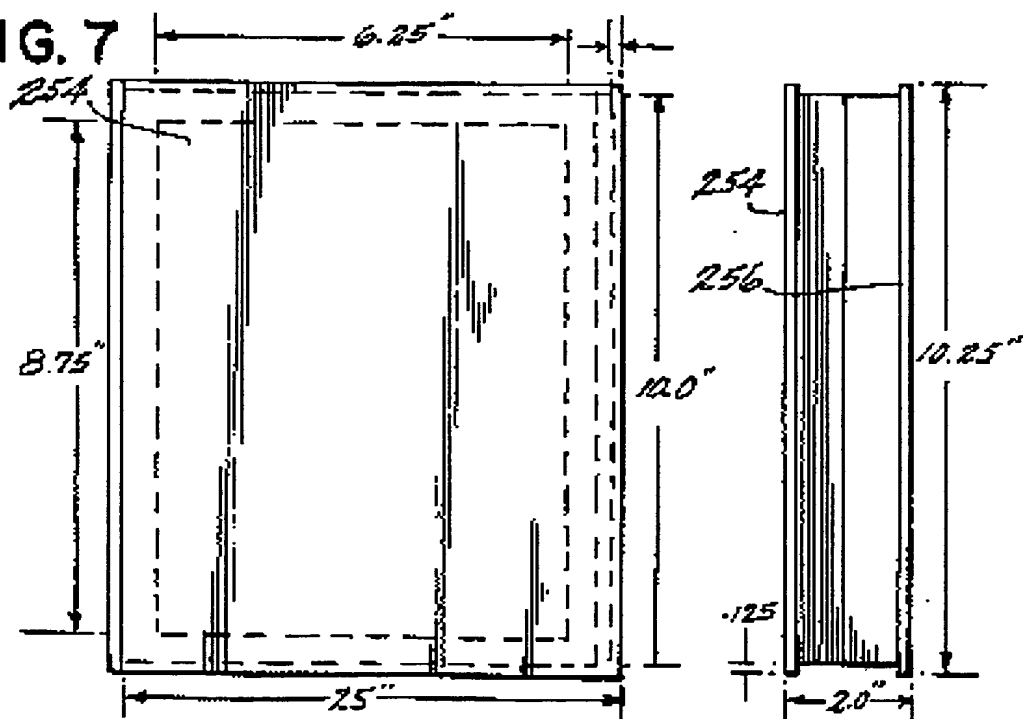


FIG. 6

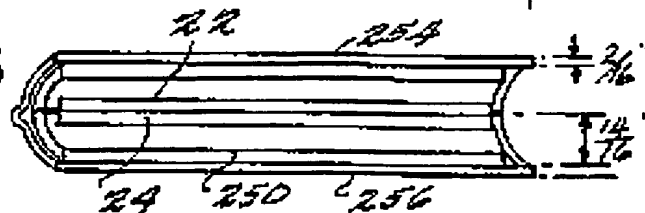
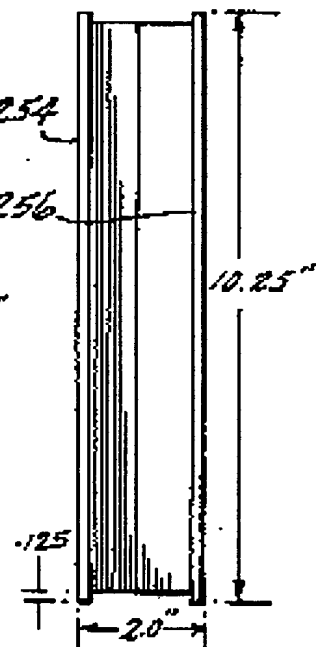


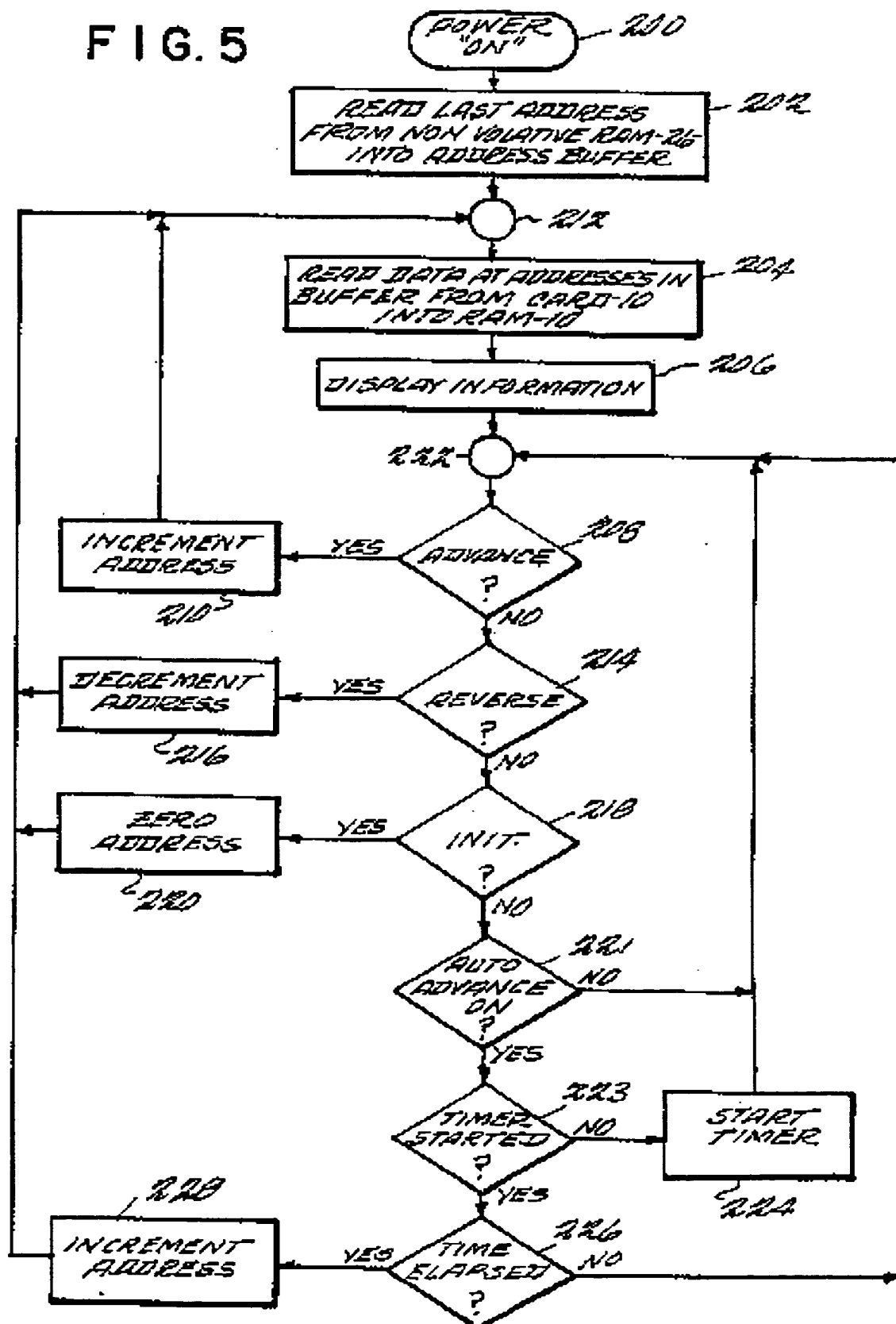
FIG. 8



SUBSTITUTE SHEET

4 / 6

FIG. 5



5 / 6

FIG. 9

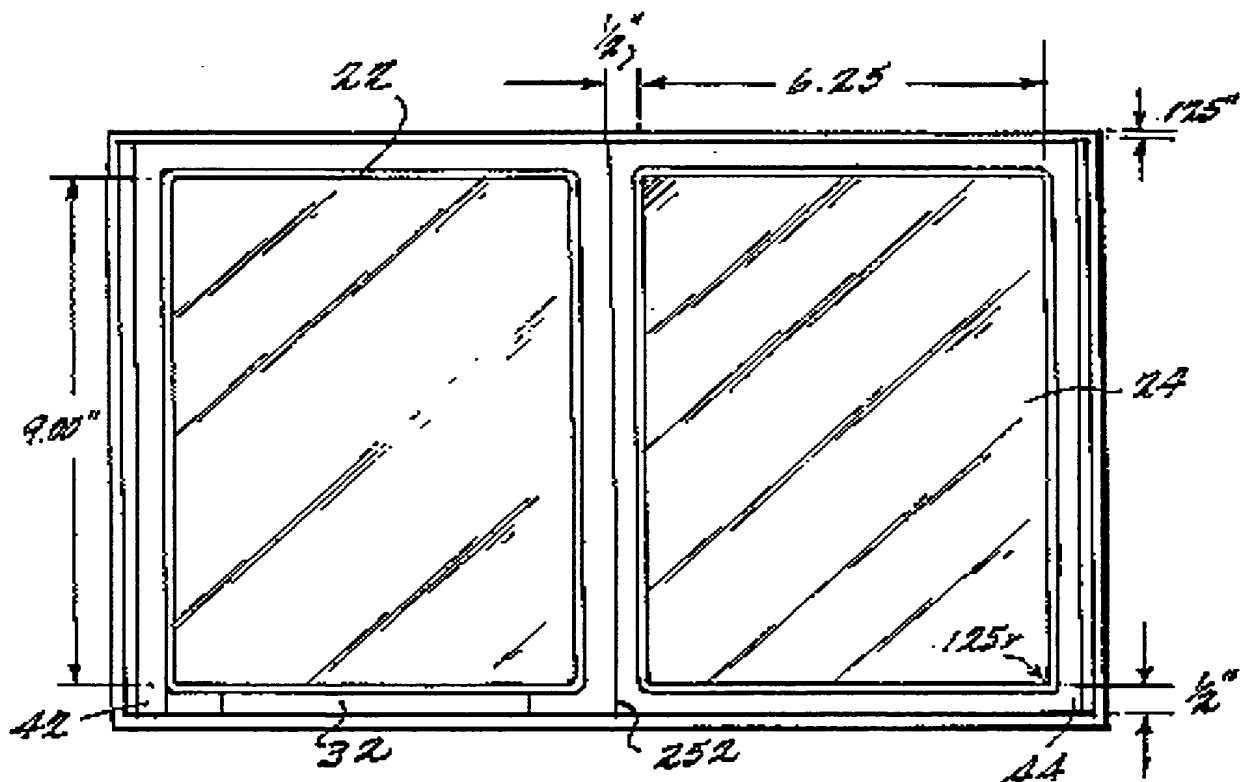
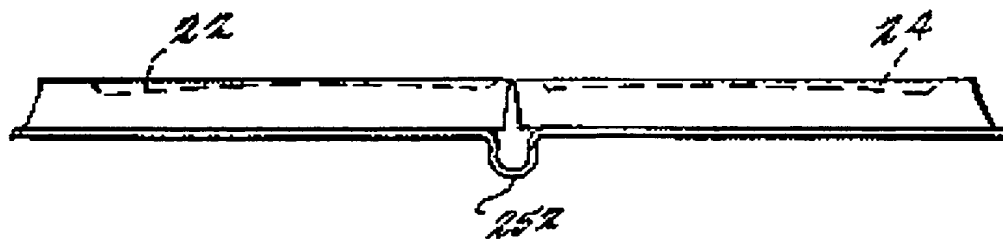


FIG. 10

6/6

FIG. 11

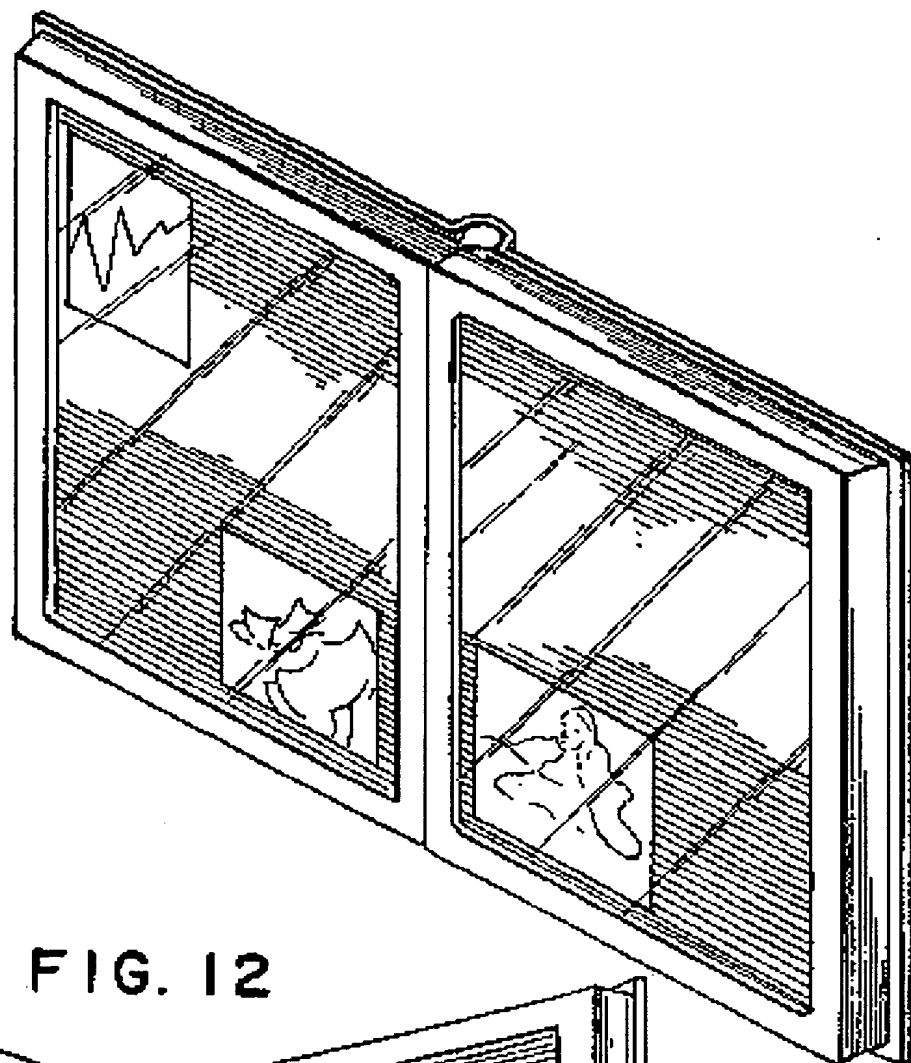


FIG. 12

